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FOR CURIOUS YOUNG MINDS 8 TO 14

Brainspace

A SMART & INTERACTIVE MAGAZINE

JUNE/JULY 2025

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EXTRACT IT FROM A BANANA!

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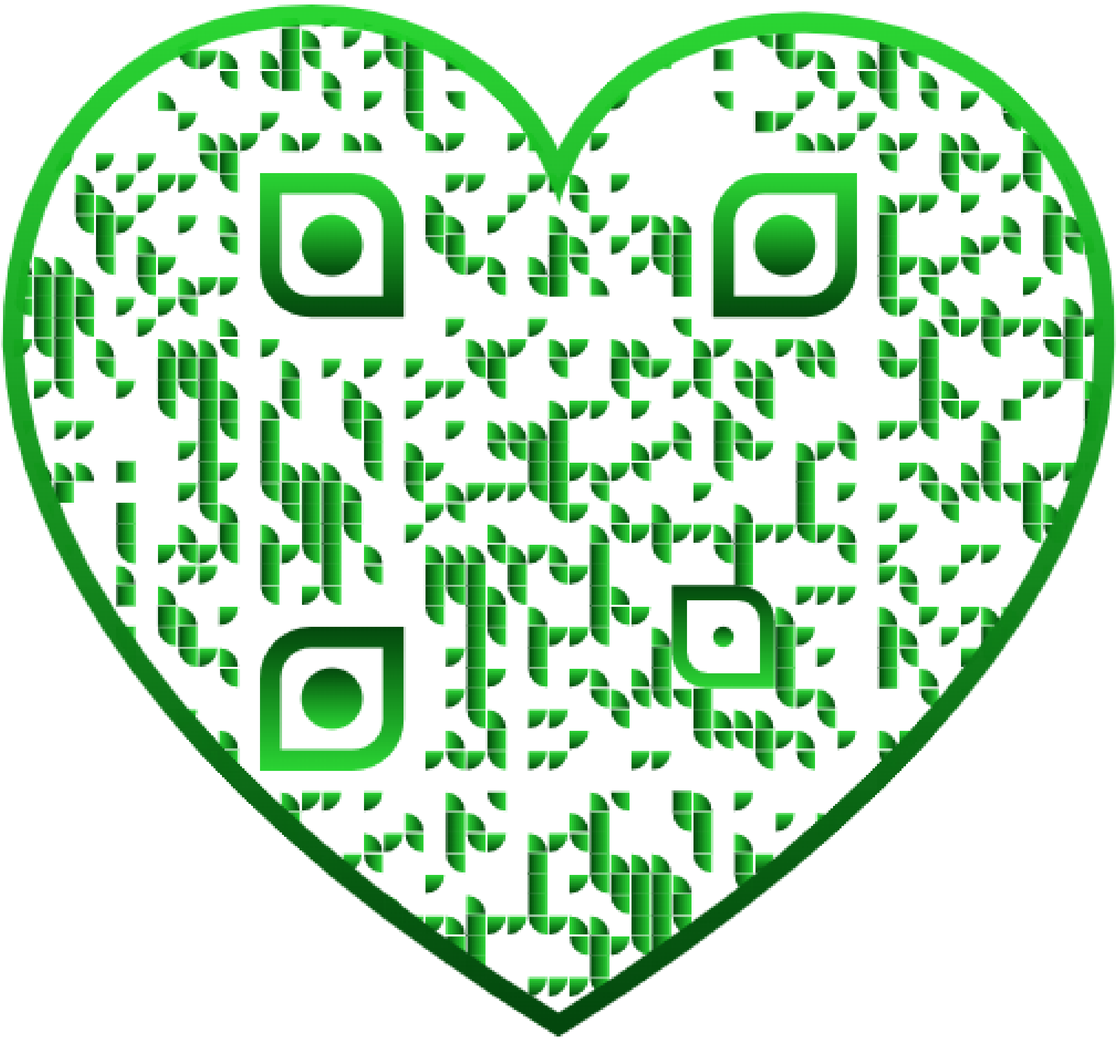
ONE-OF-A-KIND CREATURES

UP
IN THE TREES ARE NEW LIFE DISCOVERIES

MAKE SOME NOISE

EXPERIMENT WITH SOUND AND MOTION



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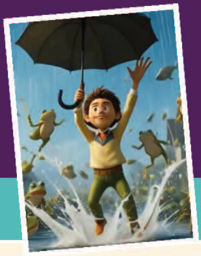
TREES FILTER WATER
TINY BUT MIGHTY!
THEY BUG US BUT WE NEED THEM
BIG MEG!
THE MYSTERIOUS MEGALODON



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Brainspace magazine is published six times a year: February, April, June, August, October and December

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brainspacemagazine.com

Periodical postage paid at Canada Post, Ontario, Canada.

POSTMASTER:
Send address changes to
Brainspace Publishing Inc.
394 Ontario Street,
Newmarket, ON L3Y 2K4

Funded by the Government of Canada

SUBSCRIPTIONS
Canada $35 • US $50 • International $90
Bulk rates for schools and libraries available
Prices are subject to taxes and shipping rates

ISSN 2291-8930

If you would like to contribute to ***Brainspace*** magazine, please email info@brainspacemagazine.com

MISSION
Brainspace magazine produces intelligent and engaging articles for students ages 8 to 14 in a format that bridges the gap between print and digital technology to expand literacy and promote optimal learning.

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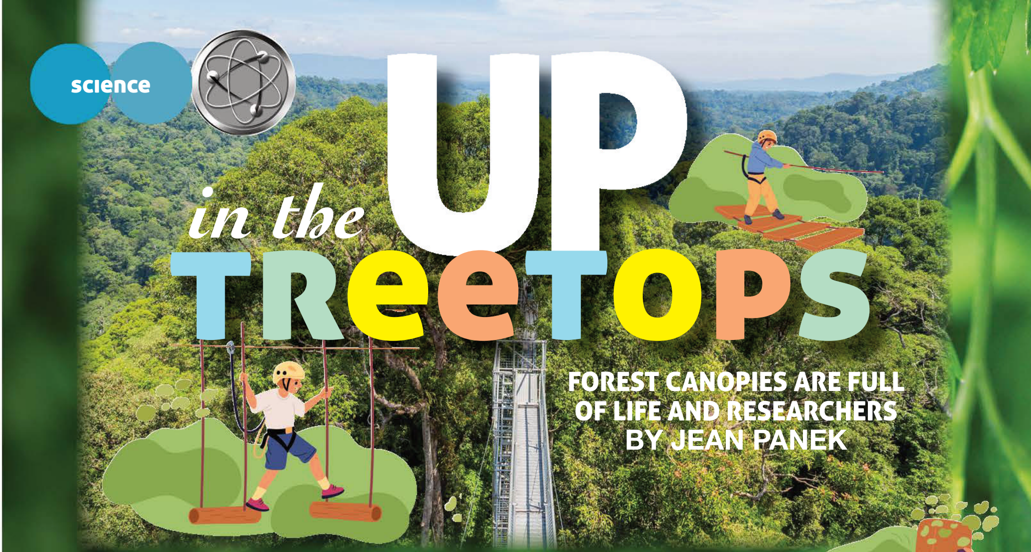
science

UP in the TREETOPS



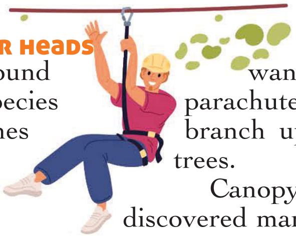
FOREST CANOPIES ARE FULL OF LIFE AND RESEARCHERS

BY JEAN PANEK

Treetop Barbie was the first in a line of scientist Barbies designed by Nalini Nadkarni, a female forest canopy researcher, to inspire girls to be scientists.

A forest canopy researcher—or arbornaut—is a scientist who has never outgrown the love of tree climbing. They commute to work by ascending ropes, towers, or stairs, to reach laboratories atop the world's forest canopies. Once they're high above the ground, they might hang in harnesses, walk across rope bridges or stand gently on branches, wearing soft shoes to protect the trees.

THE UNSEEN WORLD ABOVE OUR HEADS



Canopy researchers have found hidden worlds with new species way up high in the branches of the world's tallest and oldest trees. Ferns, lichens, mosses – even shrubs and trees – grow on thick treetop branches that are the foundation for the homes of all sorts of organisms. When the organisms, plant life and mosses die, they decay and turn into soil, creating aerial gardens with vines and "floors" like tree forts. Some animals live their entire lives in the treetop world. The wandering salamander parachutes from branch to branch up in the redwood trees.

Canopy researchers have discovered many surprises, but a huge breakthrough was solving a tree paradox. Coast redwoods, the tallest trees in the world, can grow as high as a 3-storey building. These giants seemingly defy gravity to pull water from their roots up to their topmost leaves 100 m (328 ft) off the ground. How do redwoods lift water so much higher than other trees?

Sometimes called the "8th continent," the hidden world of forest canopies is still mostly unexplored, waiting for the next arbornaut to ask questions. While treetop climbing requires special safety equipment, over 70 canopy walkways around the globe are open to the public, a great way to spy on treetop worlds!

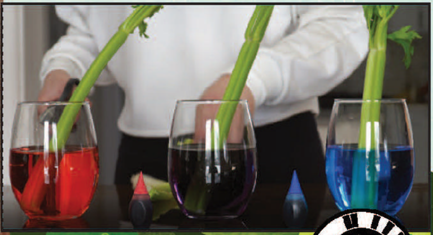
The Redwood Paradox

We know water enters trees through roots underground, and then ascends through hollow cells in the trunk (called xylem, like a tree's plumbing) to leaves. With over a hundred million leaves, redwoods need a lot of water, up to 605 litres (160 gallons) of water per hour (nearly a bathtub full, so never share a bath with a redwood)!

Canopy researchers measured the speed and direction of water flowing inside the tree, and took leaf samples to measure water chemistry. What they discovered rocked the forest science world. The water chemistry in the redwood's highest leaves matched the chemistry in fog water, not in soil water. So redwood trees drink fog through their leaves – almost half the water they need! And at night, water flow reverses inside the tops of redwoods, and the leaves become a sky "root system," absorbing water for the tree. Redwoods are often immersed in dense fog along the California coast. Using fog water avoids the challenge of lifting water against gravity, allowing redwoods to grow so tall.

For instance, redwoods along California's rainy North Coast arrange their leaves so that the ones that absorb water grow low on their trunks, with the photosynthesizing leaves higher up near the tree's crown, in order to better collect light from the sporadically shining sun. Redwoods further south, in sunnier, drier areas, do the opposite: Their water-absorbing leaves grow nice and high where they can more easily capture fog and rain.

ILLUSTRATION BY ANNIE WILKINSON



Launch Zappar to watch this demonstration on how water flows in plants

THE CLUES ANIMALS

PICTURE THIS: you are an animal researcher and have been assigned the task of identifying all the species that live in a particular lake. What steps would you take to complete your assignment successfully and ensure that you don't miss or overlook any species?

Traditional approaches

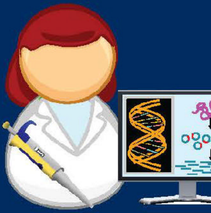
Perhaps you could take a boat to the middle of the lake and document all the marine life that swims by. Maybe you could set up a waterproof video camera to capture all the action underwater.

Unfortunately, despite the many hours you spent on the boat, you couldn't possibly spot all the species beyond your field of view. And even though the video camera had high-quality resolution, it might fail to capture clear images because some debris was stuck to the lens.

If only there was a better way to identify all the species that live in the lake. There is a better way! It is called eDNA.

What is eDNA?

Environmental DNA (eDNA) is genetic material that living or dead beings shed in their surroundings. These traces of DNA are found in materials such as hair, skin cells, saliva and feces in soil, snow, air and water.



A snake slithering through a field can leave bits of DNA on the grass blades, and a polar bear walking on snow can shed DNA in the paw prints it leaves behind. DNA from fur and skin floats in the air particles near zoos, and marine life sheds DNA while swimming through water.

PLAN B

So now that you know that aquatic creatures shed DNA in water, what would you do differently to accomplish your task of identifying all the species that live in the lake? If you thought of collecting samples of lake water and bringing them to a lab for DNA analysis, you're right!

Researchers wear gloves and carefully scoop water into sterile containers to avoid contaminating the samples. They store the samples in a temperature-controlled environment to ensure the DNA isn't affected by excessive heat or cold.

In the lab, technicians extract DNA sequences from the samples. (We'll learn more about DNA sequences shortly.) Each sequence is entered into a DNA database and compared to sequences of known species to identify a perfect match. Each perfect match is confirmation that the species lives in the lake. Mystery solved and assignment completed!

UNEXPECTED RESULTS

What do you think might happen if a bear or squirrel spent some time in or around the lake you were studying? Since traces of DNA are present in things like fur, saliva, and feces, it is highly likely that the samples of lake water you collected also contain bear and squirrel DNA.

DNA sequences

DNA is made up of 2 strands, each built from 4 chemical bases: adenine, thymine, guanine and cytosine (A, T, G and C). Combinations of A, T, G and C are repeated in different orders in a DNA strand to create a sequence that is unique to each species on the planet.

LEAVE BEHIND

BY JAN KERTESZ

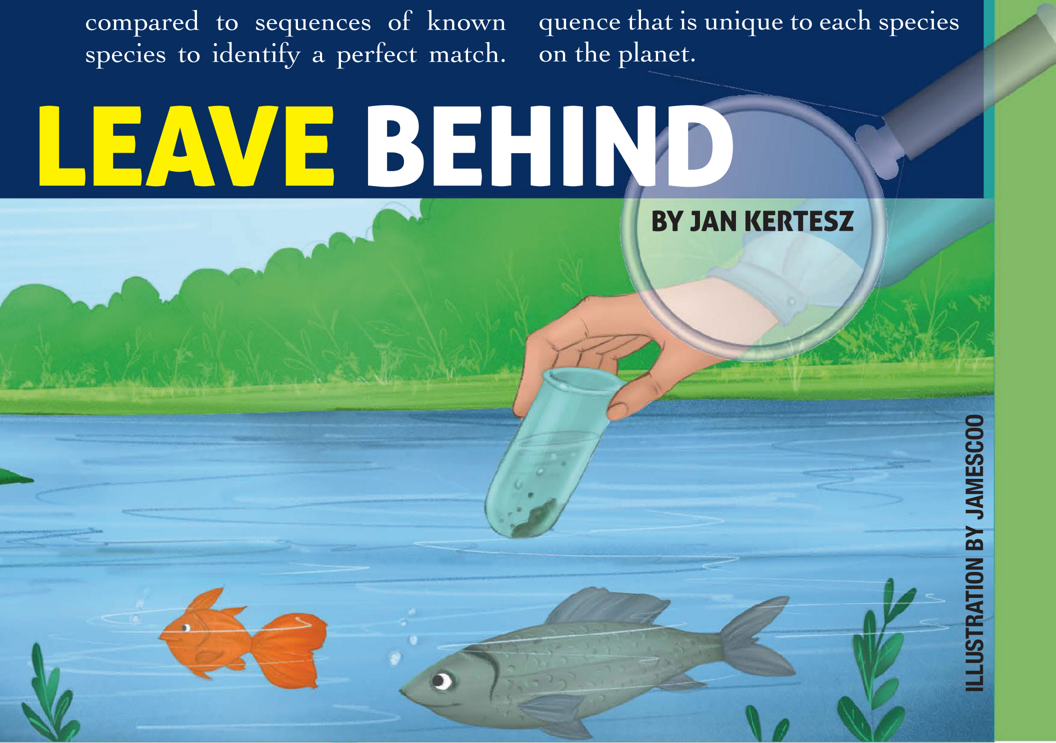


ILLUSTRATION BY JAMESCOO

DNA

Genes and Chromosomes

Where did life begin and how are there so many life forms? Did we all evolve from the very first living organism? To explore our genetic origins, we have to look into DNA.

BY NICOLE DELAY

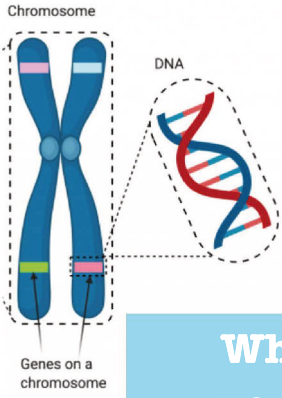
FACT Living things share common DNA.

Did we all evolve from the same thing? Physicists, astronauts, doctors and most scientists continue to research and explore the origin of DNA – the code for our genetics. Scientific research indicates that humans share common DNA with all species from the Five Kingdoms of Life. So does this mean you share the same DNA as a banana?

60% of your genes are like a banana's!

Yes. Our human genetic sequence is similar to that of other organisms, including plants. We know this because our human genes are identified in many other species. For instance, approximately 99.9% of your DNA is similar to other humans. We share 98% of our DNA with chimpanzees.

THE SECRET FAMILY RECIPE Your bones, eyes, ears, hair, teeth, muscles and blood are the result of your family genes – like a recipe. The chromosomes are like a page in your book that holds your recipe, and your DNA is the list of possible ingredients that give the genetic instructions, such as having brown vs green or blue eyes.

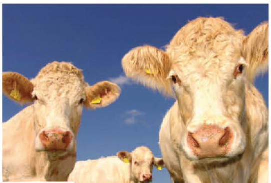


Genes made of DNA, determine your physical traits.

DNA contains genetic information and gives genetic instructions.

Chromosomes are long strands of information that includes both the genes and the DNA.

What other living species do you share DNA with?


85% cow

44% bee

90% cat

65% chicken

85% dog

24% grape

47% fruit fly

24% rice

69% platypus

Genetic Facts

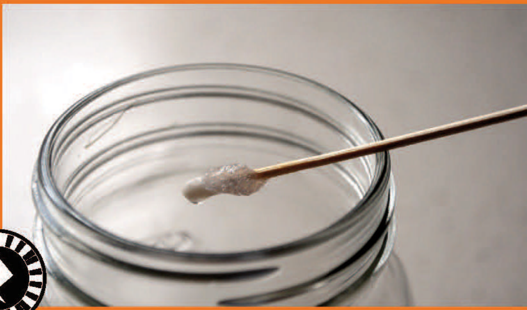
- DNA is in the genes of all living organisms.
- Genes determine gender traits (not gender identity.)
- All cells come from pre-existing cells.
- We genetically inherit our appearance from our parents.
- Some genes are dominant (brown eyes) while others are recessive (blue eyes).
- Genes come in pairs (one from each parent).

EXTRACTING BANANA DNA

byGABRIELLE MIDDLETON

MATERIALS

1	Banana
1/4 tsp	Salt
3/4 cups	Water
1 tsp	Liquid dish soap
15 ml	Rubbing alcohol
	Toothpick or skewer
	Clear glass jar
	Coffee or tea filter
	Blender



LAUNCH ZAPPAR TO WATCH

METHOD

1. Chill the rubbing alcohol in the fridge for at least 30 minutes before beginning the experiment. Cold alcohol helps the DNA separate more effectively.
2. Peel the banana and place it into a blender.
3. Add salt and warm water, just enough to cover the banana. The salt helps break down cell structures, and warm water assists in dissolving the components.
4. Blend the mixture by pulsing the blender twice, or for about 5 seconds. You want it mixed but not too runny or frothy.
5. Strain the mixture through a coffee filter or tea strainer into a clear glass jar.
6. Gently stir in 1 teaspoon of liquid dish soap, being careful not to create bubbles. The soap helps break down cell membranes to release the DNA.
7. Slowly pour the cold rubbing alcohol down the side of the jar so it forms a layer on top of the banana mixture.
8. Wait 5 minutes for the DNA to extract. You should begin to see a cloudy, stringy layer forming.
9. Use a toothpick or skewer to gently lift the DNA out of the mixture. It should look long, stringy, and slightly gooey. That's the DNA!

GUMMY BEAR OSMOSIS

byGABRIELLE MIDDLETON

MATERIALS

2	Small bowls
1 tsp	Salt
1 cup	Water, (divided into two 1/2 cups)
3	Gummy bears

LAUNCH ZAPPAR TO WATCH

METHOD

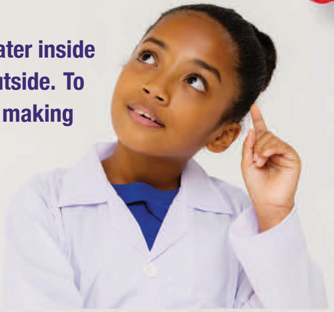
1. Pour ½ cup of water into each of two bowls, making sure the gummy bears will be fully submerged. Add the salt to one of the bowls and stir until it completely dissolves.
2. Gently place one gummy bear into each bowl. Leave them to soak for at least one hour. The longer they sit, the more noticeable the results will be. Set aside a third gummy bear as your comparison for later. As they soak, both gummy bears will begin to swell, but the one in salt water will absorb moisture differently than the one in plain water.
3. After soaking, compare the two swollen gummy bears to the original one. You'll notice that each one reacts differently. The salt water gummy bear has lost its features and will feel a gummier in texture.

OPTIONAL try the experiment with sugar instead of salt. Observe the reaction. How does it compare to the experiment done with salt?

WHY DOES THIS HAPPEN?

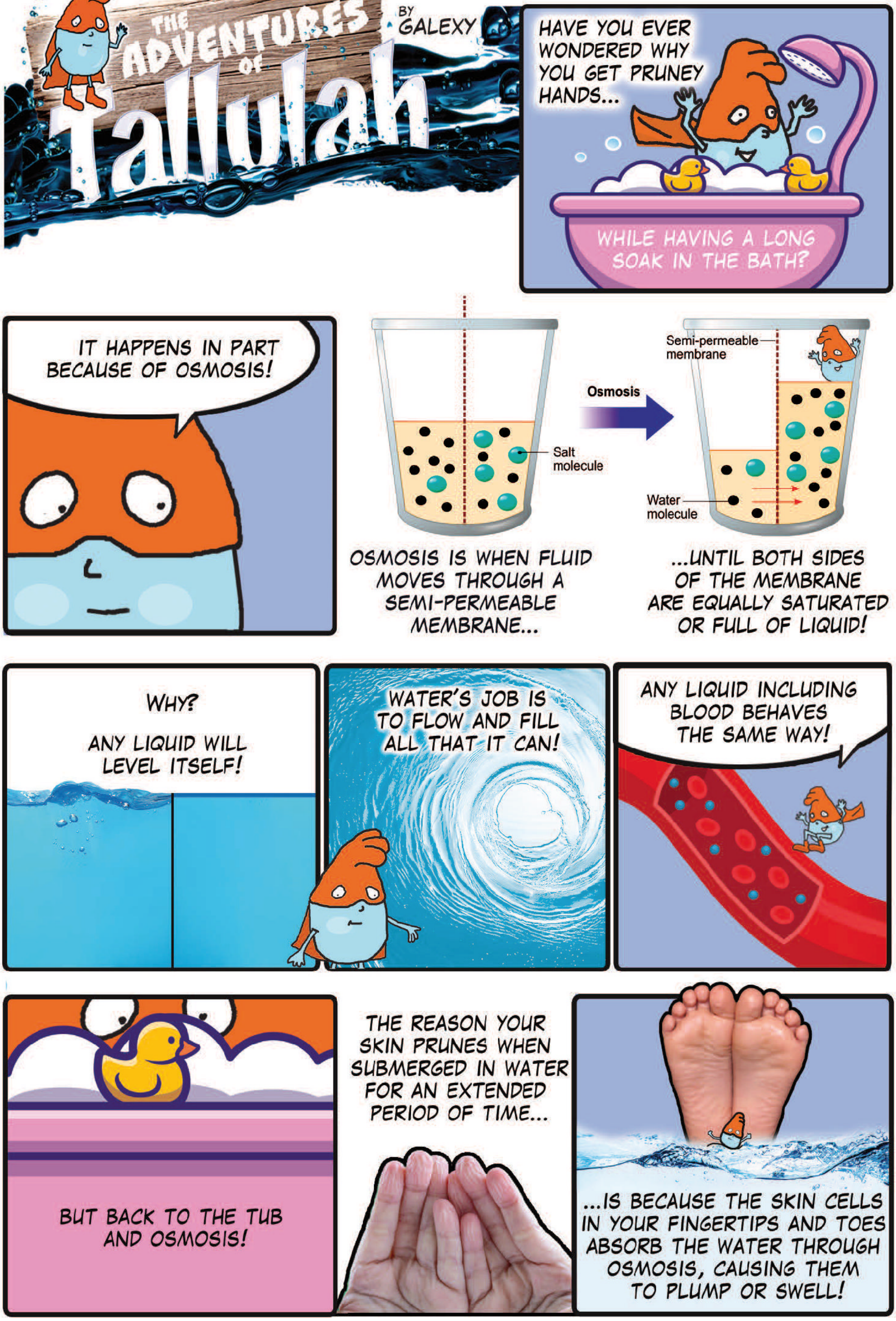
When you put the gummy bear in salty water, the water inside the gummy bear wants to balance out the salt outside. To do this, water moves into out of the gummy bear, making it shrink.

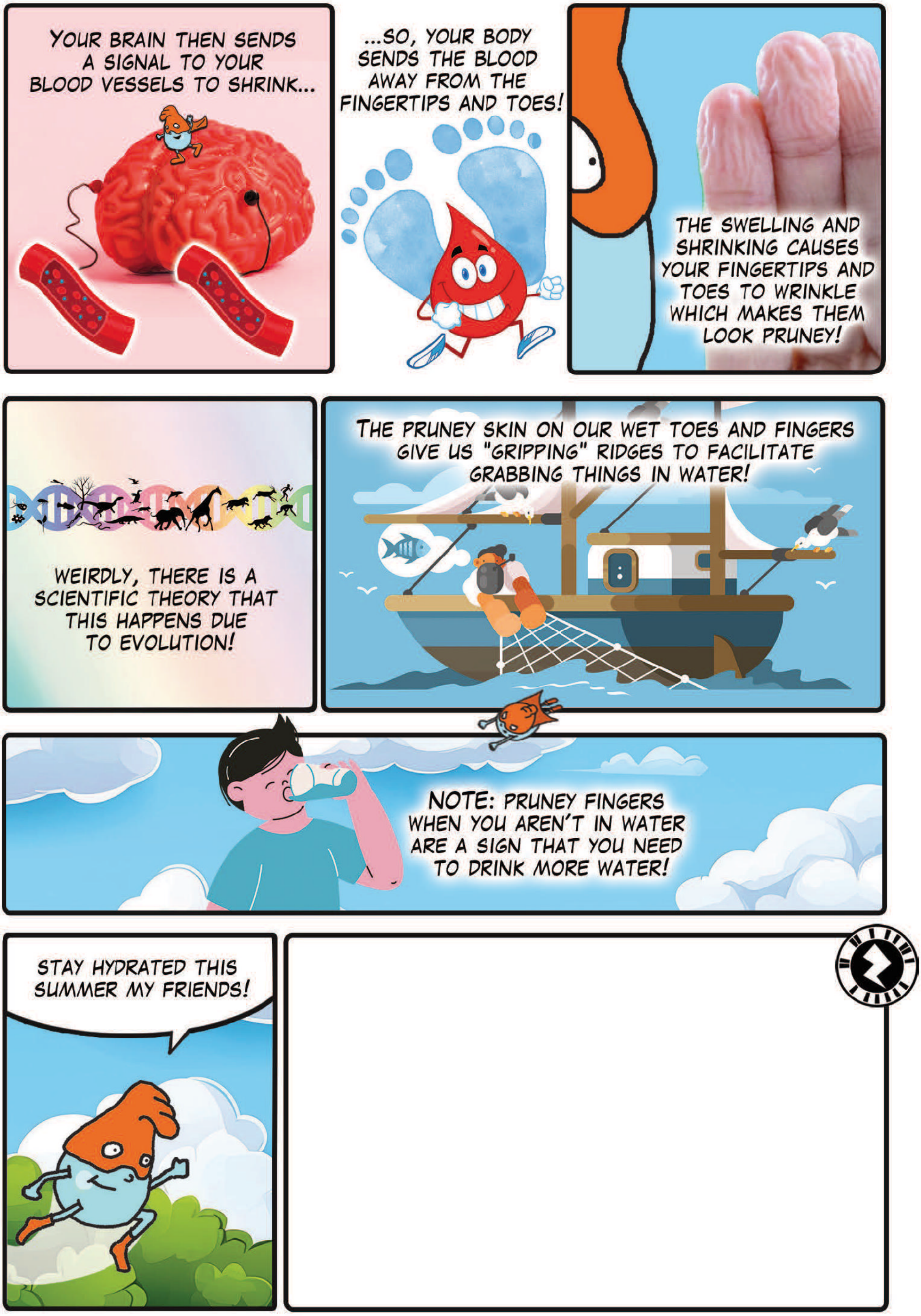
Salt Water: Water moves out of the gummy bear into the salt water to dilute it and balance the salt concentration, causing the gummy bear to shrink.



The Adventures of Tallulah

BY GALEXY


HAVE YOU EVER WONDERED WHY YOU GET PRUNEY HANDS...
WHILE HAVING A LONG SOAK IN THE BATH?
IT HAPPENS IN PART BECAUSE OF OSMOSIS!
Osmosis
Salt molecule
Semi-permeable membrane
Water molecule
OSMOSIS IS WHEN FLUID MOVES THROUGH A SEMI-PERMEABLE MEMBRANE...
...UNTIL BOTH SIDES OF THE MEMBRANE ARE EQUALLY SATURATED OR FULL OF LIQUID!
WHY?
ANY LIQUID WILL LEVEL ITSELF!
WATER'S JOB IS TO FLOW AND FILL ALL THAT IT CAN!
ANY LIQUID INCLUDING BLOOD BEHAVES THE SAME WAY!
BUT BACK TO THE TUB AND OSMOSIS!
THE REASON YOUR SKIN PRUNES WHEN SUBMERGED IN WATER FOR AN EXTENDED PERIOD OF TIME...
...IS BECAUSE THE SKIN CELLS IN YOUR FINGERTIPS AND TOES ABSORB THE WATER THROUGH OSMOSIS, CAUSING THEM TO PLUMP OR SWELL!

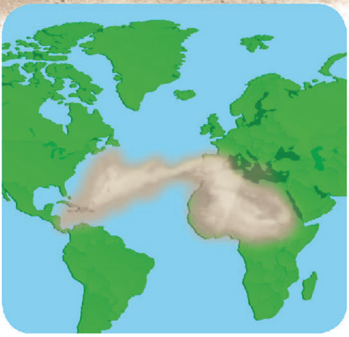

YOUR BRAIN THEN SENDS A SIGNAL TO YOUR BLOOD VESSELS TO SHRINK...
...SO, YOUR BODY SENDS THE BLOOD AWAY FROM THE FINGERTIPS AND TOES!
THE SWELLING AND SHRINKING CAUSES YOUR FINGERTIPS AND TOES TO WRINKLE WHICH MAKES THEM LOOK PRUNEY!
WEIRDLY, THERE IS A SCIENTIFIC THEORY THAT THIS HAPPENS DUE TO EVOLUTION!
THE PRUNEY SKIN ON OUR WET TOES AND FINGERS GIVE US "GRIPPING" RIDGES TO FACILITATE GRABBING THINGS IN WATER!
NOTE: PRUNEY FINGERS WHEN YOU AREN'T IN WATER ARE A SIGN THAT YOU NEED TO DRINK MORE WATER!
STAY HYDRATED THIS SUMMER MY FRIENDS!

Sahara Dust

By Ben Maycock

Saharan dust makes sea life robust

Every year, more than 240 million metric tonnes (264.55 million US tons) of dust is scooped off the sand dunes of the Sahara Desert by trade winds. This dust is swept up into the atmosphere and then blown across the Atlantic Ocean, where it settles thousands of kilometers away from where it started in Northern Africa. But unlike the dust in your home, these fine particles are welcome where they land!

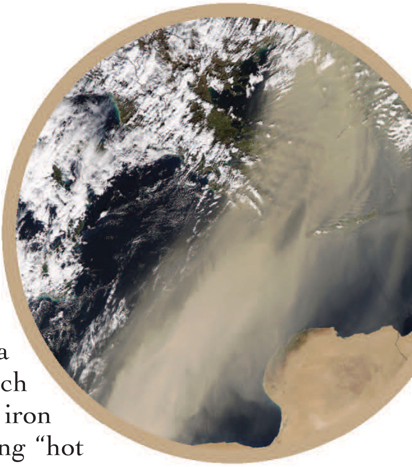


A key component of this Saharan dust is iron, which is essential to the growth of marine plants. Tiny ocean plants called phytoplankton need iron to perform photosynthesis, a process in which they turn carbon dioxide into energy. In turn, photosynthesis not only supports the phytoplankton but also the small fish and other creatures that eat them – and even larger predators that feed on those animals.

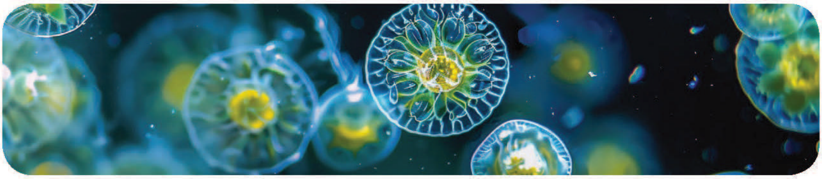
IRON ENDS UP IN THE OCEANS, CARRIED THERE BY RIVERS, MELTING GLACIERS, HYDROTHERMAL ACTIVITY AND ESPECIALLY WIND.

TINY OCEAN PLANTS CALLED PHYTOPLANKTON NEED IRON TO PERFORM PHOTOSYNTHESIS

As the Saharan dust moves through the air, chemical reactions make the iron in it more available to ocean life. Researchers believe sunlight and acids in the atmosphere cause this transformation by breaking down the minerals that hold iron, making it more accessible to organisms such as phytoplankton.



Some dust lands on islands such as Bermuda and the Bahamas, turning the soil red. But much of it falls into the Atlantic Ocean, providing iron to areas that may be nutrient poor, thus creating "hot spots" of life. Scientists studied samples of dust found on the seafloor, taken from four different locations.



Two were near Africa, while the other two were closer to North America. They found that the farther the dust travelled, the less reactive iron remained in the sediment. This suggests that during its journey, the iron becomes more soluble – meaning it dissolves more easily in water – and gets absorbed by phytoplankton before it ever reaches the ocean floor. Interestingly, scientists also found that Saharan dust might contribute iron to places such as the Amazon rainforest. This could help fertilize plants there too. The study's findings could help us better understand how dust impacts ecosystems and the global carbon cycle. Since phytoplankton absorb carbon dioxide – a greenhouse gas – their growth could even play a role in regulating Earth's climate.

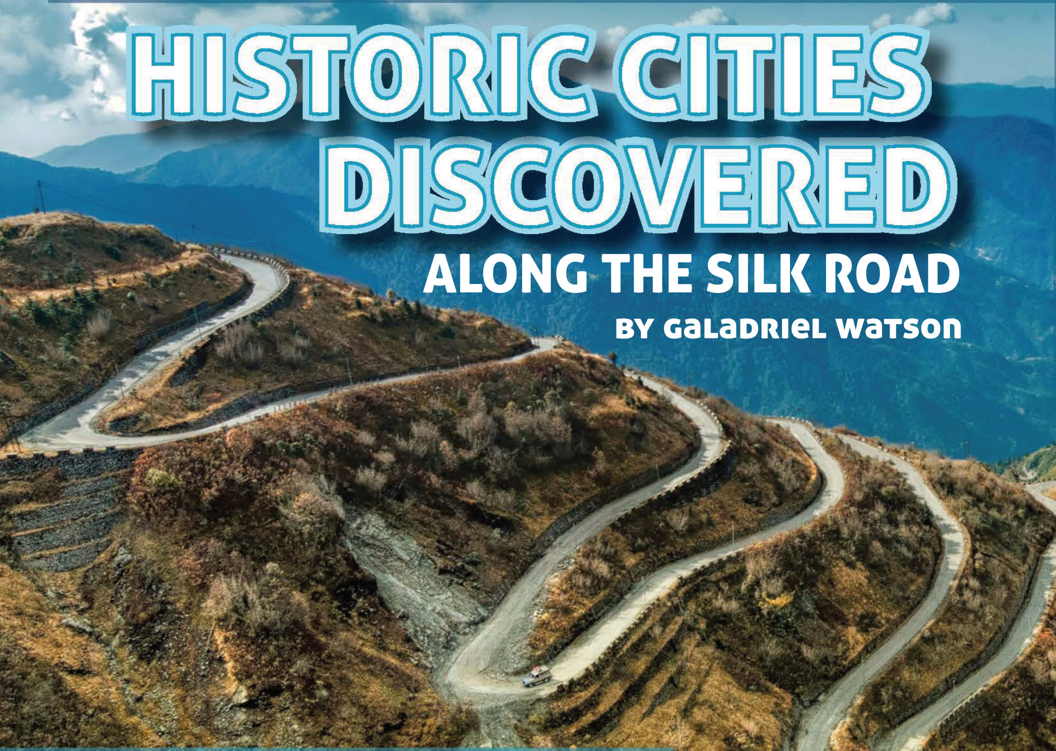
The Saharan Air Layer (SAL) is an extremely hot, dry, and sometimes dust-heavy layer of the atmosphere that often sits above the cooler, more humid surface air of the Atlantic Ocean.

Imagine you hop on an airplane in Toronto, travel east for over 18 hours, land in the Central Asian city of Tashkent in the country of Uzbekistan, and then drive about 4 ½ hours south. You'll end up in beautiful rolling mountains, with trees dotting the grasslands. It will look so peaceful, but you'll actually be standing where a large community once bustled in medieval times.

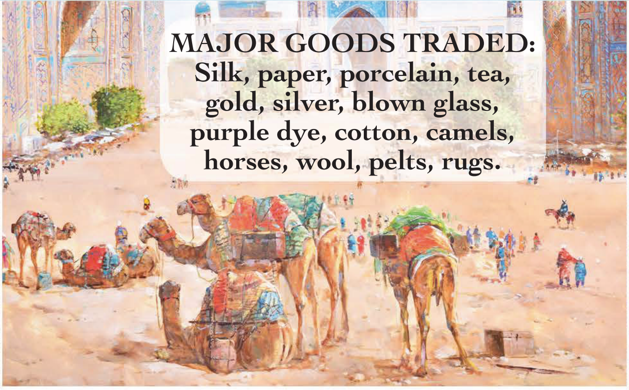
HISTORIC CITIES DISCOVERED

ALONG THE SILK ROAD

BY GALADRIEL WATSON



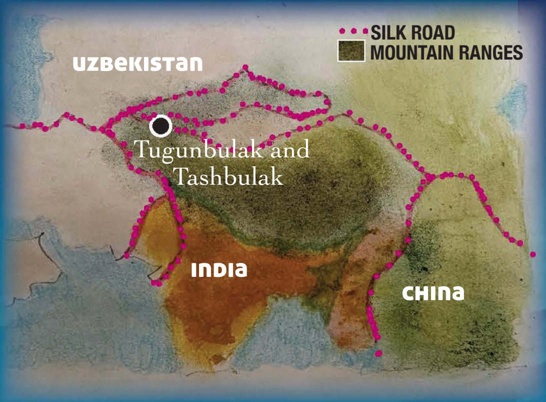
The Silk Road 130 B.C.E. until 1453 C.E.



MAJOR GOODS TRADED:
Silk, paper, porcelain, tea, gold, silver, blown glass, purple dye, cotton, camels, horses, wool, pelts, rugs.

Collecting LIDAR data over the Ganges and Brahmaputra River Basin.ogv

LAUNCH ZAPPAR TO WATCH



Welcome to Tugunbulak

Until recently, the sites of Tugunbulak and nearby Tashbulak were hidden from view, as they had been worn down and buried under layers of soil. Researchers knew people had once lived there – they'd found pieces of pottery, for example – but they didn't realize how large the settlements actually were.

Both are situated about 2,000 metres (6,561 feet) above sea level, which is really high for large settlements. (In Canada, Lake Louise in the Rocky Mountains is the highest community, at 1,600 metres or 5,249 feet.) At such altitudes, the weather can be harsh, the terrain rugged, and it can be hard to grow food.

Using lidar technology, the researchers mapped the two Uzbekistan locations—and were excited by what they discovered. Inhabited from the 6th to 10th centuries, Tugunbulak consisted of more than 300 structures, including buildings, roads, a fortress and walls dotted with watchtowers. First occupied in the 8th century, Tashbulak had nearly 100 structures.

How did so many people survive there? The undulating grasslands suggest they may have raised animals such as cattle, sheep, goats and horses. They may also have produced iron and steel, as the surroundings are rich with iron ore.

Also, the two cities were right on the Silk Road, a 6,400-km (3,977-mile) network of routes that people used for more than 1,500 years to trade items such as silk and gold between Europe and East Asia. This means that citizens had lots of opportunities to get what they needed by conducting business with folks passing through.

Before this study, researchers thought that the mountainous regions along the Silk Road were hostile places. Now they know there were at least good-sized communities there.

What is lidar?

Lidar technology can map areas that humans can't easily see. Mounted on something airborne such as a drone, the equipment pulses lasers down to Earth's surface and records how long it takes for the light to bounce back. This information enables it to measure the height of items on the ground, such as the outlines of long-buried buildings.

Genghis Khan:

Leader of the Largest Empire

BY MARNIE FERGUSON

By the thirteenth century (the 1200s), all the continents on Earth were populated with many different groups of people. There were kingdoms and empires, and their kings and emperors were always looking to make their realms bigger – or at least stop attacks from others who wanted more land.

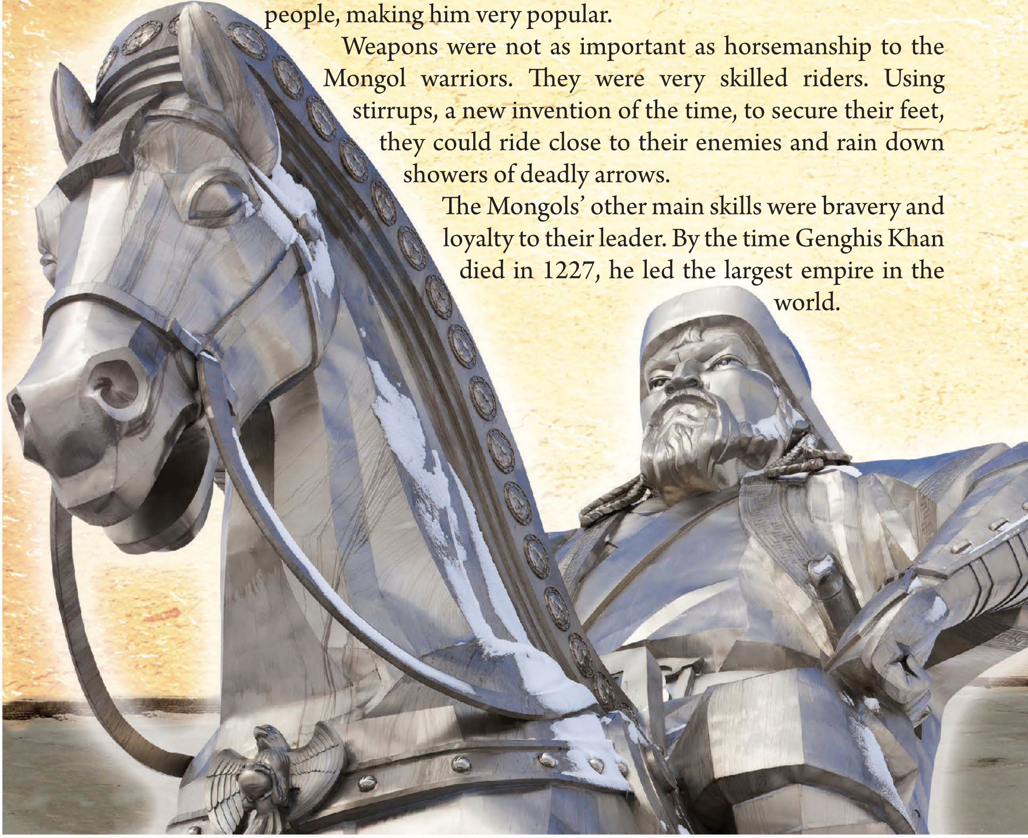
In Asia, there was a young Mongol boy named Temüjin. He was cast out, and sent away from his clan with his mother and siblings. Temüjin's father, leader of a small clan, was poisoned when Temüjin was 9 years old. As was the custom at the time, his family was left to wander the land and survive on their own. They foraged for food, eating whatever they could find, even mice.

During those difficult times, young Temüjin decided to become a great leader. He moved up in the clans and after 40 years of war, he was given the title of the "universal leader," or Genghis Khan.

Genghis Khan and his armies went on to conquer most lands in Asia. He was ruthless but very skilled. He also shared the winnings of war with his troops and the Mongol people, making him very popular.

Weapons were not as important as horsemanship to the Mongol warriors. They were very skilled riders. Using stirrups, a new invention of the time, to secure their feet, they could ride close to their enemies and rain down showers of deadly arrows.

The Mongols' other main skills were bravery and loyalty to their leader. By the time Genghis Khan died in 1227, he led the largest empire in the world.

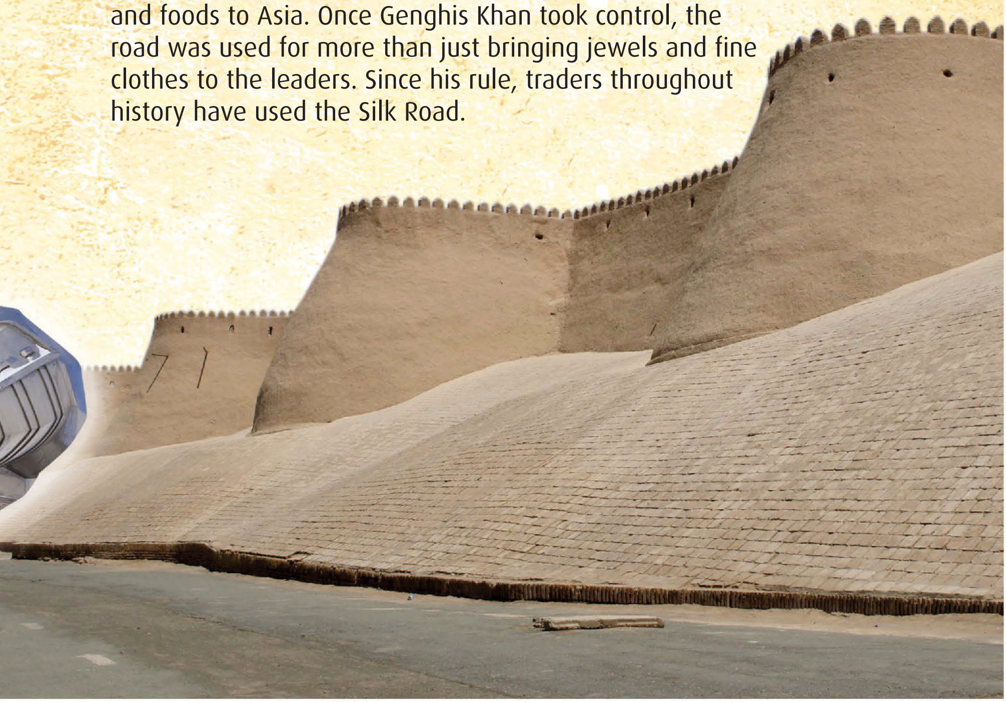


LAUNCH ZAPPAR TO WATCH

On The Silk Road With Genghis Khan

Genghis Khan is also known for saving the Silk Road, a network of routes that stretched across Asia. The road was very important for trade – silks, teas, spices and other goods from China were traded for foods, weapons and new inventions needed from Europe.

The road had previously been controlled by the wealthy and powerful leaders who used it to amass riches, rather than bring new tecchnology and foods to Asia. Once Genghis Khan took control, the road was used for more than just bringing jewels and fine clothes to the leaders. Since his rule, traders throughout history have used the Silk Road.



EXTRA Cheese PLEASE

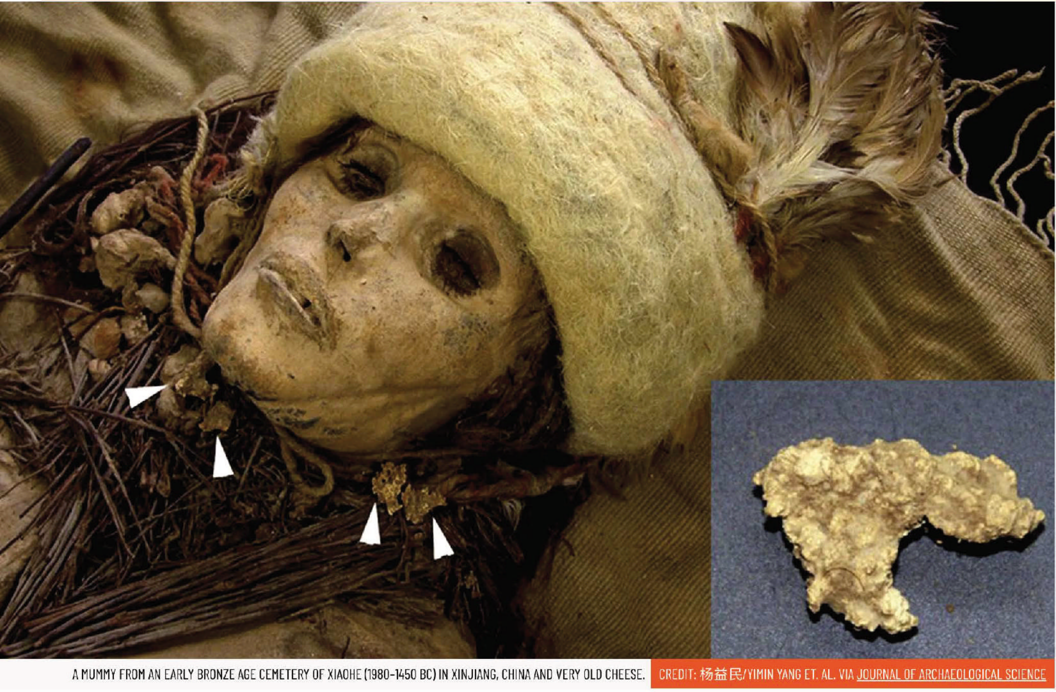
BY HOLLY BENNETT

How long do you suppose people have been making cheese? A few hundred years? Maybe a thousand?

Would you believe 7,000 years?! That's what archeologists think, based on finding pottery strainers that seem designed for cheese-making. But nobody had found any actual ancient cheese – until now.

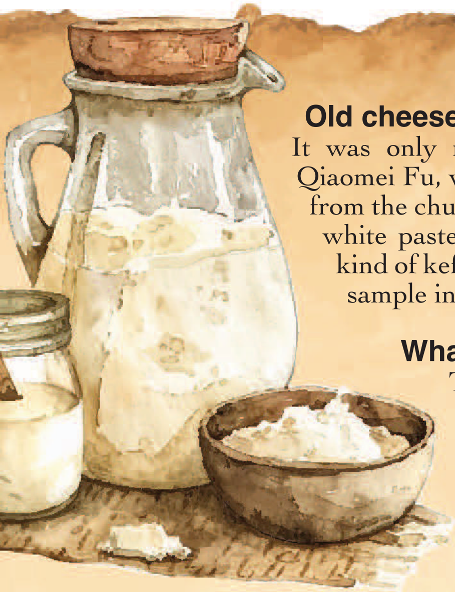
Cheesy mummies

The story starts in northwest China back in the late 1990s, when archeologists excavated a Bronze Age cemetery and found many 3,500-year-old mummies. The mummies were dressed in warm clothes, and their faces were smeared with a white substance. Some had bumpy beige lumps strung around their necks.



A MUMMY FROM AN EARLY BRONZE AGE CEMETERY OF XIAOHE (1980–1450 BC) IN XINJIANG, CHINA AND VERY OLD CHEESE.

CREDIT: 杨益民/YIMIN YANG ET. AL. VIA JOURNAL OF ARCHAEOLOGICAL SCIENCE



Old cheese

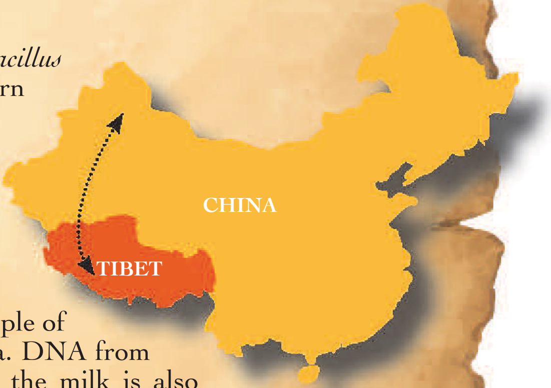
It was only recently that a Chinese paleontologist, Qiaomei Fu, was able to piece together bacterial DNA from the chunks and confirm that they, along with the white paste on the mummies' faces, were in fact a kind of kefir cheese! It's the oldest preserved cheese sample in the world.

What is kefir?

The ancient cheese contains strains of *Lactobacillus* that are still found in modern kefir, a fermented drink similar to yogurt that can be strained to make a soft cheese. It's made by adding "starter grains" of kefir (which contain live bacteria and yeast) to milk, which starts the fermentation process. That's what the chunks around the mummies' necks likely were – starter grains to enable them to to make cheese in the afterlife. Of the 3 samples studied, 2 contained cow DNA and 1 contained goat DNA, showing these people used both kinds of milk to make cheese.

Tracing the history of kefir

By comparing the types of *Lactobacillus* found in the ancient kefir to modern strains, scientists can learn how early cheese-making spread in the ancient world. For example, the *Lactobacillus kefiranofaciens* in the mummified cheese is closely related to other strains from Tibet. This suggests trade or other interaction between the ancient people of Tibet and those in northwest China. DNA from the goats and cows that provided the milk is also being studied for clues about their origins.

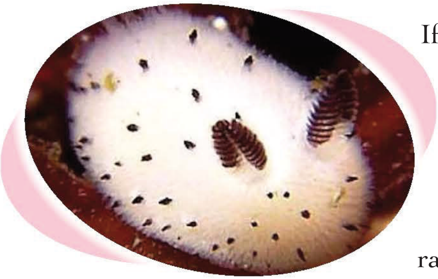


The challenge of ancient DNA

Sequencing ancient DNA is not easy! After thousands of years, only a tiny amount of DNA was left in the cheese, and it had degraded into many fragments and become contaminated with genetic information in the environment. In 2014, Dr. Fu began designing special molecules that could "capture" the *Lactobacillus* DNA from the cheese. Twenty years later, Dr. Fu and her team finally had a genome for the 3,500-year-old *Lactobacillus kefiranofaciens* that was 92 percent complete.

MEET THE SEA BUNNY

BY BEN MAYCOCK

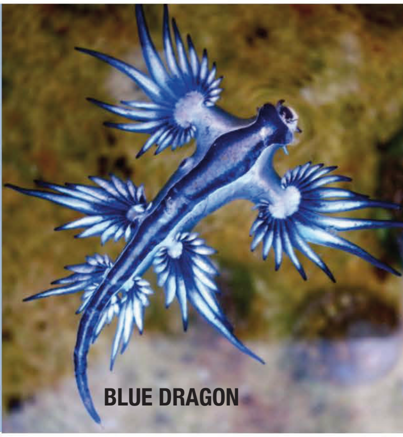


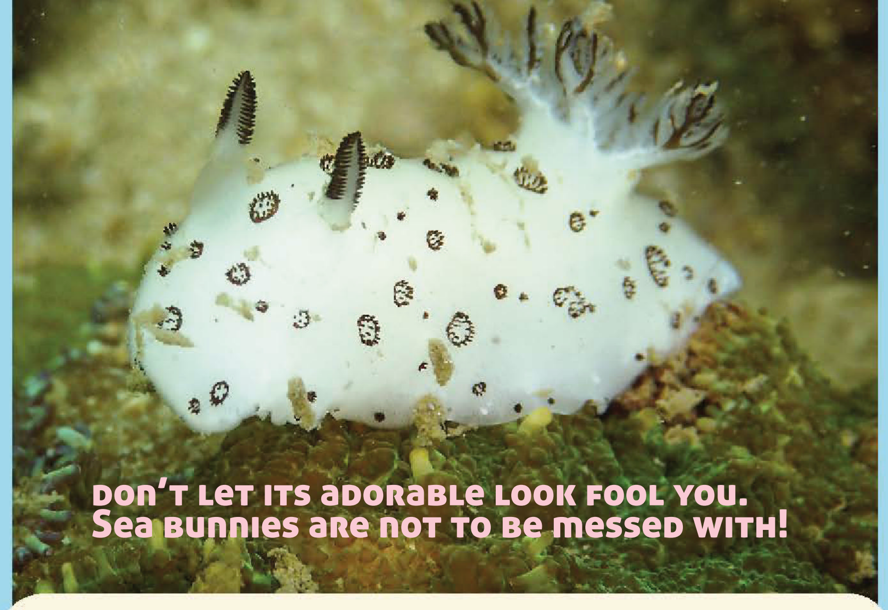
If there ever was a creature most likely to hide Easter eggs on the ocean floor, it would be *Jorunna parva.* With its fuzzy, chubby body and rabbit-like ears, this adorable organism is better known by its nickname, the sea bunny.

The sea bunny is not a bunny at all but rather a slug, or gastropod, belonging to the nudibranch (pronounced NOO-di-brank) group of animals. Nudibranch means "naked gills," referring to the way their gills are exposed on their backs. In a sense, the sea bunny breathes through its tail. The feather-like plumes on its backside are actually a cluster of gills.

There are about 3,000 species of nudibranch, a mollusc that sheds its shell while still in the larval stage. Nudibranchs often come in amazingly vibrant colours such as hot pinks, striking purples and fluorescent oranges. In white, yellow or sometimes green, the sea bunny appears at the more muted end of the nudibranch spectrum.

Other notable nudibranchs include blue dragons, Spanish dancers, leaf sheep and solar-powered slugs!





DON'T LET ITS ADORABLE LOOK FOOL YOU. Sea BUNNIES ARE NOT TO BE MESSED WITH!

Not much bigger than your thumb, sea bunnies live in the warm, tropical waters of places such as Japan, the Philippines and the Indian Ocean. They spend most of their time at the bottom of the ocean, clinging to plants or rocks.

The sea bunny's fuzzy ears are called rhinophores, horn-like structures that can sense chemicals in the water. This helps them locate food and mates, or detect predators to avoid. They can even sense vibrations and changes in water pressure with them.

Don't let its adorable looks fool you. Sea bunnies are not to be messed with! It mainly feasts on sponges and jellyfish, which are full of toxins. The toxins are harmless to sea bunnies but, stored inside their bodies, dangerous to predators. As a result, most creatures leave them alone!

Sea bunnies feed with the help of a radula, a tongue-like ribbon lined with a row of sharp microscopic teeth for scraping and cutting food. Radula teeth are even strong enough to pierce the shells of other molluscs!

THE FUZZ ON A SEA BUNNY'S 'EARS' ISN'T SOFT LIKE A LAND BUNNY'S FUR—IT'S STIFF AND HELPS THE SEA BUNNY "SMELL" THINGS IN THE WATER.

SEA BUNNIES ARE HERMAPHRODITES, WHICH MEANS THEY HAVE BOTH MALE AND FEMALE PARTS, BUT THEY CAN'T FERTILIZE THEIR OWN EGGS. THEY STILL NEED A PARTNER TO REPRODUCE.

BIOLOGY

THE TIME TRAVELLING JELLY

WOULD YOU LIKE TO BE A BABY AGAIN? A COMB JELLY CAN GO BACK TO BEING A BABY!

BY BEN MAYCOCK

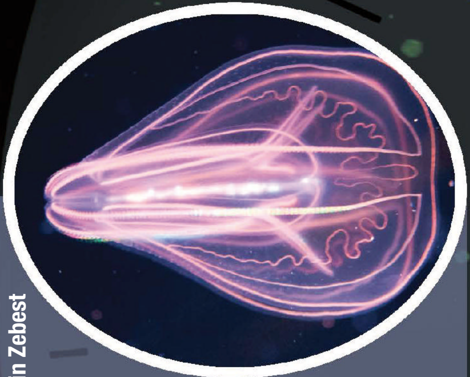


photo: Orin Zebest

The comb jelly is one of very few animals known to pull off this biological “time travel,” joining the ranks of the famous “immortal jellyfish.” This remarkable discovery happened quite by accident when a startled scientist realized that an adult comb jelly was missing from its tank and a larva was in its place! Observations have verified that under stress, the creature will shrink and take on the physical characteristics and feeding behaviours it had at a much earlier stage in its life.

The comb jelly or "sea walnut" is a fascinating creature that can reverse its aging process. This unique ability is a survival technique that allows it to transform from its adult stage back to its larval stage when it experiences stress, such as an injury or starvation. It is as if it is turning back time!

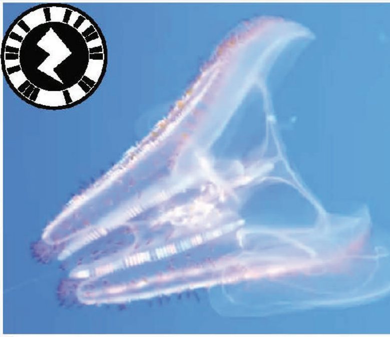
Before being recognized as a "time traveler" the comb jelly had intrigued scientists for another reason – it can fuse itself to another comb jelly, becoming a single organism! The two jellies combine to share not only bodies, but also nervous and digestive systems!

THE LIGHT SHOW

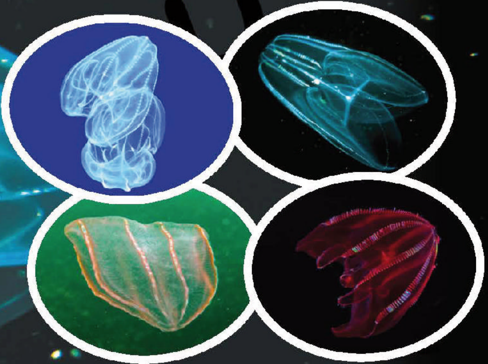
Most comb jellies are bioluminescent, meaning they can produce and emit light. They can also generate a rainbow of colours as light diffuses through their cilia while they move through the water.

With their ancient origins and remarkable abilities, comb jellies may be the key to unlocking the secrets to biology, aging and survival. They may hold valuable clues for scientists studying regeneration and longevity — and they prove the ocean still holds plenty of extraordinary secrets.

LAUNCH ZAPPAR TO WATCH



There are more than 100 known species of ctenophores.



Comb jellies may be the oldest animals on Earth. They are found around the world and in every part of the ocean, from polar to tropical and in shallow coastal waters to open ocean depths. Members of the phylum Ctenophora, (Greek for “comb-bearers.”), they move through the water using a "comb," rows of hairlike appendages called cilia.

Comb jellies are often mistaken for jellyfish because both are gelatinous and transparent, but they’re quite different. While comb jellies move through the water using their cilia like oars on a boat, jellyfish move by pulsing their bodies forward. And unlike jellyfish, comb jellies do not sting. They catch their prey with sticky tentacles.

LAUNCH ZAPPAR TO WATCH THIS JELLYFISH

ANIMATON BY GOLAI

IT'S RAINING Fish and Frogs

BY PASCALE BIDER

All around the world, there are tstrange accounts of animals falling from the sky. Ancient Greek texts describe rains of frozen frogs. As recently as 2021, a city in Texas reported a rain of fish! Though they sound like myths, these strange rains are scientifically possible.

Rains of animals may occur naturally. Scientists think that strong winds during storms may be to blame. In specific kinds of stormy weather, spinning winds can create a phenomenon called waterspouts. These cones of wind look like tornadoes and act like vacuums. They can suck up air, water and maybe even small animals! A waterspout can travel over water and onto coastal land,

sometimes ending up far from where it formed.

As the waterspout loses energy over time, it will drop whatever it sucked up – which could include fish or frogs!

Sometimes, animal rains are actually an illusion. In the central Australian desert, when it rains hard, the ground is covered in frogs! Though it looks like these frogs fell with the rain, they actually came from the ground. Because of the extremely hot and dry weather in this part of the world, Australian water-holding frogs can't live above ground for very long. They spend most of their lives burrowed in the dirt, wrapped in thick waxy cocoons that keep in their moisture. They are able to sense when it's raining, which means it's safe to come out. Because it rains so rarely in the Australian desert, the frogs may only be able to leave their burrows a few times a year. They can even spend several years in a row underground!

Occasionally, humans make it rain animals on purpose! Anglers in Utah love to fish in quiet lakes far up in mountains, but if too many people are fishing, the lakes may run out of fish. To prevent this, staff at the Utah Division of Wildlife Resources (UDWR) have a plan: they breed fish in farms, then bring some of those baby fish back into the lakes. However, it's not always possible to carry tanks full of fish up remote mountain paths. Instead, UDWR staff load their fish tanks into a plane. Then, they dump the fish out as they fly over the lakes. In a single flight, the plane can drop a rain of more than 35,000 fish into their new lake homes!

Bigger critters have also gone skydiving. In the Northern Rocky Mountains, beavers used to be hunted for their beautiful fur. There was such a demand for beaver pelts that by the late 1940s, there were almost no living beavers left in the Northern Rocky Mountains at all. To fix this, conservation officers in Idaho took 76 beavers from other regions in the U.S., packed them up in special padded boxes with parachutes attached, and loaded them into a plane. As the plane flew over the Northern Rockies, the officers chucked the boxed beavers out into the sky!

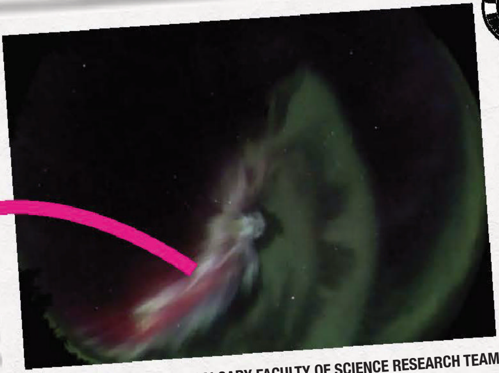
Surprisingly, this plan worked! The rain of beavers successfully parachuted down to start new families in the mountains. 70 years later, the Northern Rocky Mountain beaver population is thriving once more.

LAUNCH ZAPPAR TO WATCH

BREAKING NEWS

RARE WHITE AURORAS

BY COLLETTE YVONNE



COURTESY UNIVERSITY OF CALGARY FACULTY OF SCIENCE RESEARCH TEAM

LAUNCH ZAPPAR TO WATCH

SCIENTISTS SPOT MYSTERIOUS WHITE SPECTRES IN THE NORTHERN LIGHTS!

Have you ever seen the aurora borealis, also known as the northern lights? Auroras are glowing green, red, purple, blue, pink or yellow waves of light that dance and flicker across the night sky. But scientists have noticed something odd – ghostly white streaks mixed in with the colourful light show! These lacy veils of light, recently spotted by researchers at the University of Calgary in Canada, don't seem to be part of the northern lights at all. Instead, they might be caused by something similar to another strange sky glow called STEVE (Strong Thermal Emission Velocity Enhancement).

Ghostly Images

In 2023, space scientist Emma Spanswick was looking at images taken by a special camera network called TREx (Transition Region Explorer). TREx is a network of low-light cameras in Canada that monitors Earth's upper atmosphere in full colour. Spanswick and a colleague noticed something odd – grayish-white threads of light stretching across the pictures. "We were both like, 'What is that?'" she said.

Curious, the team searched older TREx images and found 30 more examples of ghostly light over Lucky Lake and Rabbit Lake in Saskatchewan. The faint streaks sometimes wove through the usual colourful auroras, while in other cases, they appeared right after the auroras had faded.

WHAT'S CAUSING THE WHITE LIGHTS?

Auroras occur when charged particles from the Sun collide with different gases in Earth's atmosphere, causing each gas to emit a specific colour. But the white streaks don't seem to work the same way. Scientists analyzed their glow and found something surprising – they emit all the colours of a rainbow, which makes them appear white to the human eye.

This is similar to STEVE, which looks like a smooth purple or white arc. STEVE typically appears in mid-latitudes, farther south than the usual northern lights. Scientists believe STEVE is caused when super-fast plasma (a super-hot gas) rushes through the atmosphere, superheating the air. But the pale flickering veils seen in Saskatchewan look different from STEVE, making scientists wonder if they are related or entirely new.

Scientists think the mysterious streaky patches of light could also be caused by atmospheric heating, but there is no sign of hot plasma.

The mystery remains:

- what's heating the air to create these white streaks?
- and why do they only show up in certain places?

A Clue to Solving STEVE?

By studying these streaks, scientists might uncover new clues about how STEVE forms. While the patchy streaks of light look different from STEVE's smooth purplish arcs, they might share the same science behind their glow.

For now, these glowing white veils remain a fascinating mystery.

WHERE AURORAS APPEAR IN THE SKY

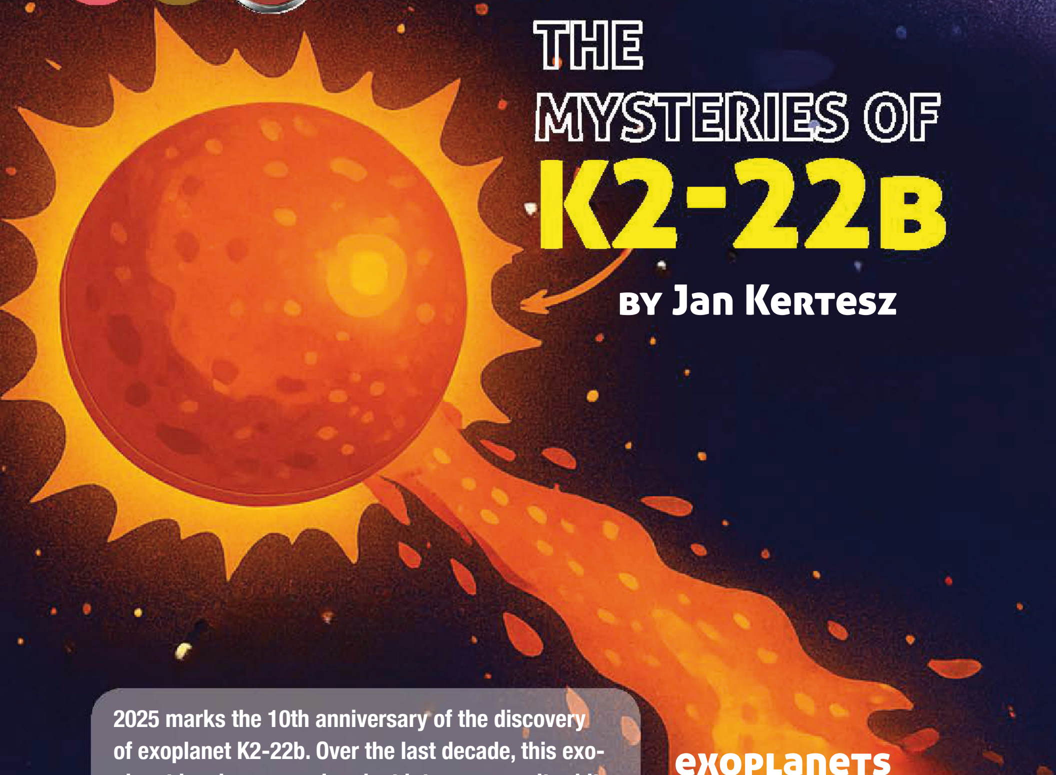
CLOSER TO THE NORTH POLE, auroras can appear overhead or even to the south, depending on the observer's location.

IN THE NORTHERN HEMISPHERE, auroras generally appear in the northern sky when viewed from mid-latitude locations (Canada, northern USA, Europe).

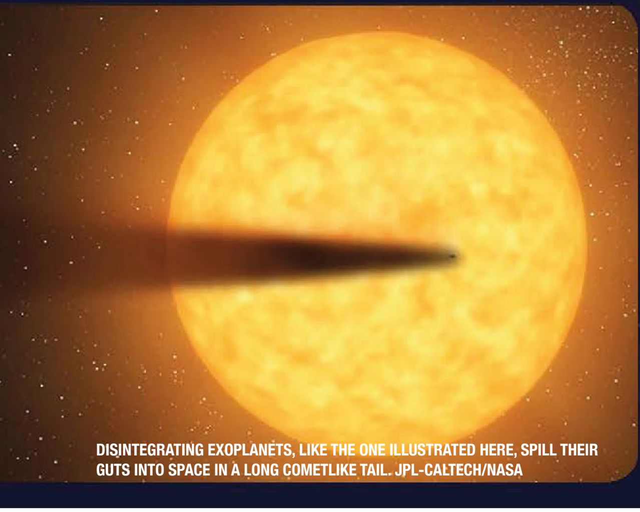
IN THE SOUTHERN HEMISPHERE, auroras (aurora australis) are seen in the southern sky, mostly near Antarctica.

THE MYSTERIES OF K2-22B

BY Jan Kertesz



2025 marks the 10th anniversary of the discovery of exoplanet K2-22b. Over the last decade, this exoplanet has been spewing dust into space as it orbits its host star called K2-22. Let's learn more about exoplanets and why the contents of K2-22b's dust trails are so fascinating and mysterious.



DISINTEGRATING EXOPLANETS, LIKE THE ONE ILLUSTRATED HERE, SPILL THEIR GUTS INTO SPACE IN A LONG COMETLIKE TAIL. JPL-CALTECH/NASA

exoplanets explained

An exoplanet (short for extrasolar planet) exists outside of our solar system. Most exoplanets, including K2-22b, orbit a star, while others, called rogue exoplanets, float freely in space.

There are over 5,800 confirmed exoplanets, and NASA estimates billions more have yet to be found. (Most of the exoplanets we know about are in the Milky Way galaxy, which is the farthest region our most sophisticated telescopes can currently explore.)

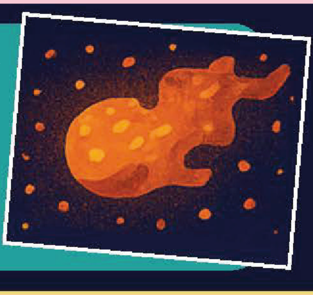
K2-22B TIMELINE

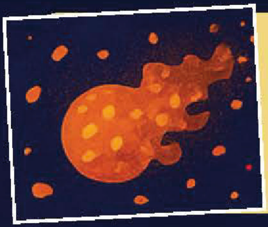
2015 NASA announces the discovery of a “disintegrating rocky planet” called K2-22b. The exoplanet is about 800 light-years away from Earth. A single light-year equals 9.4 trillion kilometres(5.8 trillion miles) so K2-22b is very far away! It is also much larger than our planet. If Earth were the size of a nickel, K2-22b would be the size of a baseball.

Why do scientists think K2-22b is disintegrating?

While some exoplanets take years to orbit their host stars, K2-22b does so in just 9 hours. Circling so close to its star exposes K2-22b to temperatures as high as 1,827°C (3,320°F). This scorching heat causes the exoplanet to lose material from its interior and spew clouds of dust in a trail in front of and behind itself. Further research is required to confirm what the dust is made of.

2019 Results from observations of K2-22b in 2016 and 2017 indicate that the dust grains are small, and the composition of the dust trails changes rapidly. Scientists believe these rapid changes mean that K2-22b has a short lifespan, and the exoplanet should be continuously monitored to ensure opportunities to learn from it are not missed.





2021 Readings from a large binocular telescope in 2020 confirm that K2-22b is now emitting large dust particles and that there is a short time between when the dust emitted is cleared and recreated. These findings imply that there is a high rate of mass loss on K2-22b, and the exoplanet is rapidly deteriorating.

2025 Results from observations in 2024 using a light wavelength spectrometer are getting researchers closer to determining the dust’s composition. Since every type of mineral produces an identifiable wavelength of light, scientists are methodically narrowing down what the interior of K2-22b could be made of. So far, scientists have ruled out iron, magnesium oxide and silicon monoxide. But here’s where things get a bit strange. Scientists believe the dust might be nitric oxide and carbon dioxide. But these chemicals are associated with icy environments, not scorching hot ones!

If confirmed, these unexpected results mean K2-22b could be described as a disintegrating snowball. This is not what researchers expected from an exoplanet in a blistering hot environment. Research is ongoing and the mystery of K2-22b continues!

UNIQUE in their class

ONE-OF-A-KIND CREATURES

BY COLLETTE YVONNE

Get ready to meet a few of the most amazing animals on the planet! With their tough scales, solar-powered bodies, 3D vision and iron-clad exoskeletons, these creatures are some of the most fascinating and unusual animals on Earth.

The Only Solar-Powered Vertebrate

Yellow-spotted salamanders (*Ambystoma maculatum*) are shy creatures found in North America's forests. They can grow to be about 15 to 25 cm (6 to 10 inches) long. They're black with bright yellow spots and like to stay hidden under logs and leaves. But here's something amazing – this species of salamander has a special trick: they can get their food from sunlight, like a plant! This is called photosynthesis. The photosynthesis happens while they are still in their egg and larvae form, living in shallow ponds where sunlight can reach them. The algae living inside the egg cells use the light to make energy. Some of that energy helps the baby salamanders grow into adults!

The Only Mammal Covered in Scales

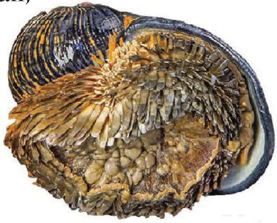
Even though pangolins (e.g., *Manis crassicaudata*) look like reptiles, they're actually mammals. These shy, nocturnal (active at night) animals live in parts of Asia and Africa. Sometimes called scaly anteaters, they are the only known mammals in the world covered in tough, protective scales made of keratin – the same stuff as your fingernails! These special scales act like armour. If a predator gets too close, a pangolin curls into a tight ball. It can also swing its sharp, scaly tail like a club to fight off an attacker. Pangolins don't have teeth, so they use their long, sticky tongues — sometimes longer than their whole body – to catch ants, termites and larvae.

The Only Insect With 3D Vision

The praying mantis (*Sphodromantis lineola*) has superhero vision – it's the only invertebrate known to see in 3D! But there's a catch: its depth perception only works when prey moves. In a study, scientists glued tiny 3D glasses on a group of mantises, and showed them movies of moving dots. The insects successfully attacked virtual prey even when each eye saw different images! Unlike humans, mantises ignore full images and focus only on motion to calculate distances. With 5 eyes (2 large, 3 small) and quick, trap-like forelegs, a praying mantis is a deadly hunter of fast-moving insects such as flies, crickets or moths.

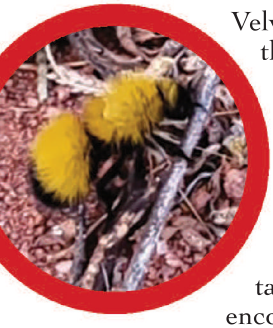
The Only Animal with an Iron Exoskeleton

Deep in the Indian Ocean, nearly 3 kilometres (1.86 miles) below the surface, live a tiny wonders – scaly-foot snails (*Chrysomallon squamiferum*). These deep-sea molluscs are about the size of a golf ball, measuring just 4 to 5 cm (1.5 to 2 inches) wide. They are the only known animal on Earth with iron built into both their shell and the hundreds of tough scales covering their feeet. The snails' hard metal armour helps them survive in one of Earth's most extreme environments: near scorching hydrothermal vents where water temperatures can reach up to 400°C (752°F).



VELVET ANTS:

Fluffy and fierce by Pascale Bider



Velvet ants look tiny, fuzzy and cute. Don't let that fool you though! Under their fluffy exterior, velvet ants are some of the toughest insects around. Velvet ants are not actually ants but, in fact, wasps. They are sometimes mistaken for ants because the females don't have wings. Velvet ants are parasitic. Rather than build their own nests, they sneakily lay their eggs in the nests of other insects, such as other wasps or bees. Velvet ants live most of their lives alone. This is a dangerous way to live: solitary critters are an easy target for predators. Plus, female velvet ants may have nasty encounters with other insects when trying to steal their nests. However, velvet ants are rarely attacked and killed, because they have a whole arsenal of defences! Though these fluffballs may not look dangerous to you, their bright yellow and red colours are a signal to predators. Brightly coloured animals are usually also poisonous or venomous, so predators know that they had best not take a bite. When velvet ants feel threatened, they can also rub together two parts of their abdomen to make a loud, sharp noise. Scientists have observed that this noise alone was enough to scare off predators such as shrews! Finally, velvet ants can release chemicals to emit a deterring stink. Predators can't say they weren't warned!

VICIOUS VENOM

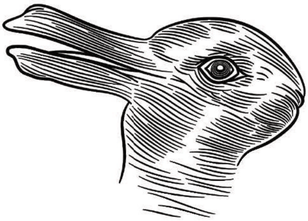
If potential attackers still don't get the hint, they're in for a painful surprise. Female velvet ants have a powerful sting and extremely painful venom. Some females have stingers more than half the length of their body! This has earned them the nickname "cow killers." Though velvet ant venom can't actually kill a cow, it can sure cause pain in vertebrate animals such as moles, shrews and humans.

Recently, scientists have taken a closer look at velvet ant venom and discovered that it is made up of multiple different chemicals. The researchers extracted these different chemicals and tested their effect on nerves of different animals. They were surprised to find that the main chemical in velvet ant venom, called Do6a, caused no effect on the nerves from vertebrate animals such as mice. Though there is a lot of it in velvet ant venom, Do6a does not cause "cow-killing" pain. But the small amount of other chemicals in velvet ant venom is very harmful to vertebrates!

So WHAT'S ALL THE Do6a FOR?

Scientists observed that this chemical did have an effect on the nerves of flies. It seems that most of the chemicals present in velvet ant venom are specifically for fighting insects. Researchers saw that when predator mantises attacked velvet ants, a stab from the ant's stinger caused the mantis to let go and recoil. From these experiments, scientists learned two things. First, that velvet ant venom contains specific chemicals for causing pain in vertebrates. Second, it also contains large quantities of one specific chemical powerful enough to make insect predators give up the fight. In conclusion, whether you're a shrew, a mole, a cow or a mantis: don't mess with the velvet ant!

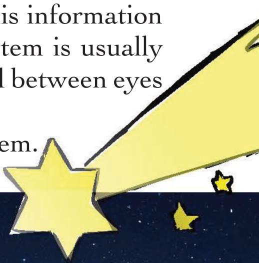
See it with your own eyes: Optical Illusions!



by PASCALE BIDER

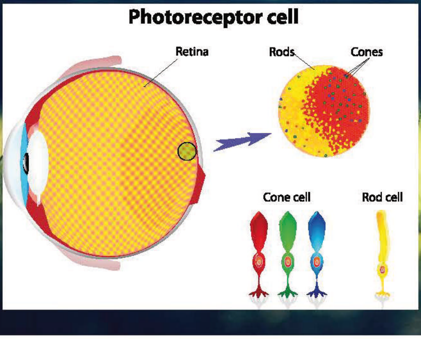
Seeing may seem like a simple thing to do, but behind the scenes, sight is a really complex process. First, your eyes use multiple different types of cells to take in light. Nerves translate this light into signals that they pass on to the brain. Finally, your brain absorbs this information and turns it into a picture that makes sense. Our visual system is usually great at this job. But every now and then, the messages passed between eyes and brain get muddled up. This can cause optical illusions.

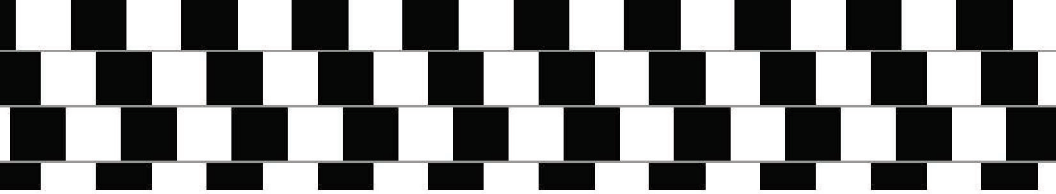
Here are a few common illusions and the science behind them.



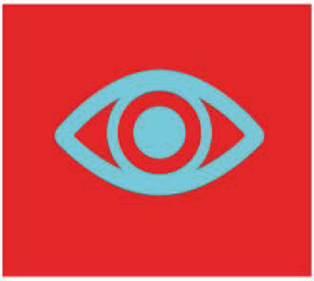
Fading stars

When you look at a starry sky, you may see lots of stars in the corner of your eyes. But when you look directly at them, they disappear! Of course, the stars are not really disappearing. We see this illusion because of the way different types of cells are arranged in our eyes. Light from a star enters our eyes through the pupil. Next, the light hits a wall of cells on the back of our eye called the retina. The retina is made up of cone cells and rod cells. Rod cells are really good at detecting light, but not good at seeing colour. We have more rod cells around the edges of our retina. Meanwhile, cone cells can detect the colour of light, but they are not as sensitive as rod cells. Our retina has a dense patch of cone cells in the middle. When we see stars on the edges of our vision, it's because our rod cells are able to pick up their faint light. When we look directly at the stars, we point our weaker cone cells towards them. Because we can't see them as well, the stars look like they're fading!



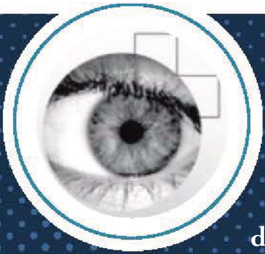


Wrong colour



Stare into this eye for 30 seconds, then look away. What do you see?

If you see a blue square and an orange eye in the middle, then you've been tricked by an optical illusion! Don't worry, it happens to everyone because of the way the cone cells in our eyes work. We have three types of cone cells: one type detects blues, one type detects greens, and one type detects reds. When we stare at one colour for a long time, some of our cone cells are working harder than others. They get tired and eventually take a break. This becomes obvious when we look away from the shape. We see an afterimage in wonky colours because some cone cells in that specific area of our eyes are shut off! Once our cones are rested, they start working again as normal.



Dissappearing dot

Your retina is almost completely covered with light-sensing cells, except for one small spot. This is where your optic nerve connects your retina to your brain. Because of this, every eyeball has a blind spot. In your day-to-day life, you have likely never noticed your blind spots, because your brain is constantly filling in the blanks for you.

To find your blind spots, try this activity:

1. On a blank piece of paper, draw two dots. The shapes should be 1cm wide and 3 inches apart.
2. Hold the piece of paper out in front of you at arm's length. Look at the left dot and close your left eye.
3. While focusing only on the left dot, slowly bring the paper towards your face. At some point, you should see the right dot disappear, then reappear.

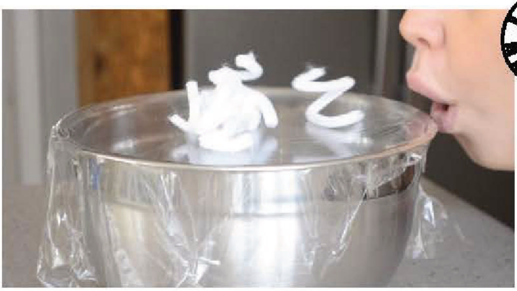
Try this again with your other eye.

Of course, the dot is not actually disappearing. We just lose sight of it as it passes through our blindspot. When the dot disappeared, you probably saw blank paper in its place. Don't be fooled though – you couldn't actually see the paper either! That was just your brain filling in your blindspot with what it thinks should be there.

PHYSICS

SOUND

Music moves us as we sway to a beat. However, sound itself produces vibrations that can physically move our eardrums and, at high intensity, will even shake our bones! Sound creates vibrations that can shatter glass and move everything from grains of sand on a speaker to pipe cleaners on a surface. Test sound and motion by conducting these 2 simple and effective experiments.



LAUNCH ZAPPAR
TO WATCH

MATERIALS

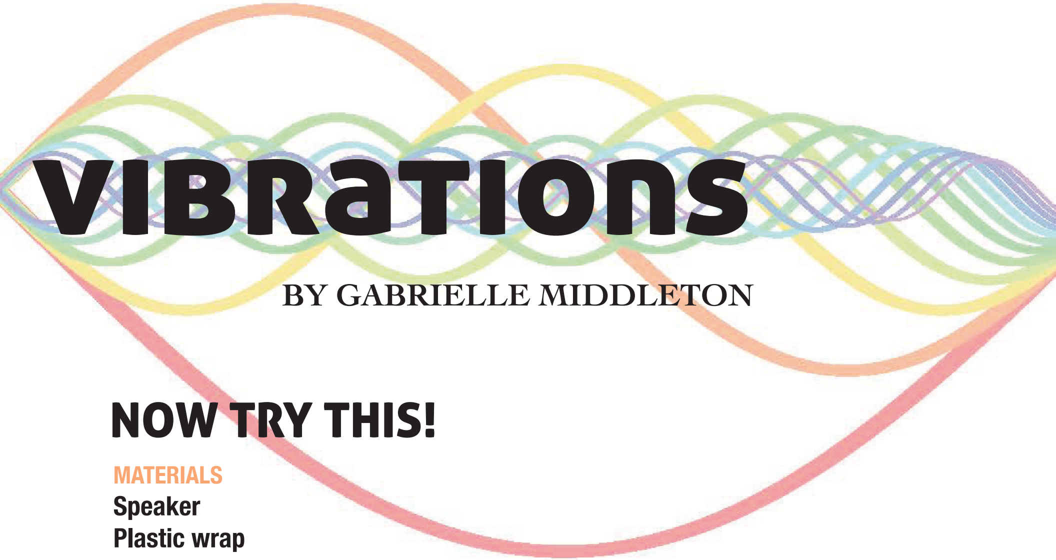
Metal bowl
Plastic wrap
Pipe cleaners (1-3)

METHOD

1. Tightly cover the top of the metal bowl with plastic wrap, making sure it's sealed securely and stretched smooth across the surface.
2. Cut each pipe cleaner in half, then twist the pieces into fun spiral shapes. Gently place them on top of the plastic wrap.
3. Now for the fun part! Stand to the side of the bowl and sing into the rim using your loudest or highest-pitched opera voice – just be careful not to let your lips touch the bowl. The sound vibrations will travel through the plastic wrap and cause the pipe cleaners to wiggle and dance!

WHY DOES THIS HAPPEN?

When you shout into the bowl, your voice creates sound waves that cause the plastic wrap to vibrate. These vibrations are transferred to the pipe cleaners, making them move. The pipe cleaners respond to the vibrations, wiggling or shifting as a result.



VIBRATIONS

BY GABRIELLE MIDDLETON

NOW TRY THIS!

MATERIALS

Speaker
Plastic wrap
1-2 tbsp sand or sugar

METHOD

1. Carefully wrap plastic wrap around the flat top of the speaker. Ensure it's tightly secured, and note that this works best with a speaker that has a flat surface.
2. Lightly sprinkle a small amount of sand or sugar on top of the plastic wrap.
3. Play a song with strong bass, turn up the volume, and watch the sand dance to the rhythm of the beat!

WHY DOES THIS HAPPEN?

When the bass plays, the speaker vibrates, causing the plastic wrap to move. This movement transfers to the sand or sugar on top, making it bounce in sync with the beat of the music.

At certain frequencies, loud sounds can hurt our ears, rattle windows and even collapse a bridge. However, sounds that are pleasing to our eardrums can relax, soothe anxiety and boost moods. Sounds such as birdsong, a cat's purr, gentle rain or a soft breeze in trees, can benefit mental health. What sound is most pleasing to you?

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